Scopus

Document details

Back to results | 1 of 1

Export Download Print E-mail Save to PDF Add to List More...

Full Text View at Publisher

Applied Mathematics and Information Sciences
Volume 9, Issue 1, 2015, Pages 197-204

Vehicle profile optimization using central composite design for pedestrian injury mitigation (Article)

Kausalyah, V.[ab], Shasthri, S.[c], Abdullah, K.A.[a], Idres, M.M.[a], Shah, Q.H.[a], Wong, S.V.[d]

[a]Department of Mechanical Engineering, Faculty of Engineering, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, Malaysia
[b]Faculty of Mechanical Engineering, University Technology of MARA, Shah Alam, Selangor, Malaysia
[c]Department of Mechanical Engineering, Faculty of Engineering, University Selangor, Shah Alam, Malaysia

View additional affiliations

Abstract

View references (18)

Pedestrian injury poses a significant problem throughout the world. Pedestrians contribute to the second largest category of motor vehicle deaths accounting for about 13% of fatalities, after occupant injuries. Therefore is vital to design pedestrian friendly vehicles to mitigate injuries and fatalities. A statistical methodology employing the Design of Experiments (DoE) is adopted in this work to obtain the optimum design parameters for the vehicle front end geometry. The work studies the feasibility of the use of Central Composite Designs (CCD) between a Circumscribed design (CCC) and a Faced design (CCF). A total of 100 simulation runs are performed and the response is tabulated. Multi linear regression analysis is performed following which, quadratic programming is used to carry out the optimization task using the Response Surface models obtained. It is concluded that the CCC offers a better prediction for the optimum values in comparison to the CCF design. The SSR value for the CCC design offers a better fit for the model yielding the value of 2.68 which is lesser than CCF's value of 2.87. In addition, the practical error margin between the predicted CCC designs and observed experimental values are 43.68 for CCC and 187.66 for CCF respectively, thus affirming the conclusion made. © 2015 NSP.

Author keywords

Design of experiments Faced and circumscribed design Optimization Pedestrian head injury mitigation Vehicle front end profile

Funding details

Funding number	Funding sponsor	Acronym
12-077-0226	Ministry of Higher Education, Malaysia	MOHE
B11-257-0735	Ministry of Higher Education, Malaysia	MOHE

ISSN: 19350090
Source Type: Journal
Original language: English
DOI: 10.12785/amis/090125
Document Type: Article
Publisher: Natural Sciences Publishing Co.

References (18)

View in search results format

All Export Print E-mail Save to PDF Create bibliography

Metrics

View all metrics

1 Citation in Scopus
45th Percentile

0.39 Field-Weighted Citation Impact

PlumX Metrics
Usage, Captures, Mentions, Social Media and Citations beyond Scopus.

Cited by 1 document

A virtual test system representing the distribution of pedestrian impact configurations for future vehicle front-end optimization
Li, G. , Yang, J. , Simms, C.
(2016) Traffic Injury Prevention

View details of this citation

Inform me when this document is cited in Scopus:

Set citation alert Set citation feed

Related documents

Crash kinematics and injury criteria validation for a deformable hybrid vehicle model
Venkatason, K. , Abdullah, K.A. , Sivaguru, S.
(2014) Applied Mechanics and Materials

Validation of pedestrian impactor testing upon hybrid vehicle front end profile
Kausalyah, V. , Shasthri, S. , Abdullah, K.A.
(2014) International Journal of Vehicle Systems Modelling and Testing

1 Traffic Safety Facts 2010: Pedestrians, [cited 2013 April 11]
(2012)
Washington (DC): NHTSA, Available from URL:
http://wwwnrd.nhtsa.dot.gov/Pubs/811625

2 Beck, L.F., Dellinger, A.M., O'Neil, M.E.
Motor vehicle crash injury rates by mode of travel, United States: Using exposure-based methods to quantify differences

(2007) *American Journal of Epidemiology*, 166 (2), pp. 212-218. Cited 123 times.
doi: 10.1093/aje/kwm064

View at Publisher

3 (2011)
Critical Factor Associated with Pedestrian Casualties in Motor Vehicle Crashes, Vehicle Safety Biomechanics, Malaysian Institute of Road Safety Research, MIROS Report

4 Crandall, J.R., Bhalla, K.S., Madeley, N.J.
Designing road vehicles for pedestrian protection

(2002) *British Medical Journal*, 324 (7346), pp. 1145-1148. Cited 82 times.

View at Publisher

5 Carter, E., Clive, N.S., Steve, E.
(2005) *Optimization of Passenger Car Design for the mitigation of pedestrian head injury Using a Genetic algorithm*, pp. 100-110.
5th European MADYMO Users Meeting

6 Niederer, M.R., Schlumpf, P.F.
Influence of Vehicle Front geometry on Impacted pedestian kinematics
(1984)
Stapp Car Crash Conference

7 Kausalyah, V., Shasthri, S., Kassim, A.A., Moumen, M.I., Qasim, H.S., Wong, S.V.
Validation Of Pedestrian Head Form and LegForm Impact Testing Upon Hybrid Vehicle Front End Profile, 2nd International Conference on Mechanical
(2013)
Automotive and Aerospace Engineering (ICMAAE'13)

8 Zhao, Y., Rosala, G.F., Campean, I.F., Day, A.J.
A response surface approach to front-car optimisation for minimising pedestrian head injury levels

(2010) *International Journal of Crashworthiness*, 15 (2), pp. 143-150. Cited 16 times.
doi: 10.1080/13588260903094392

View at Publisher

9 Liu, X., Yang, J.
Effects of Vehicle Impact Velocity and Front-End Structure an Dynamic Responses of Child Pedestrians

(2003) *Traffic Injury Prevention*, 4 (4), pp. 337-344. Cited 19 times.

View at Publisher

Injury analysis validation of a deformable vehicle front end model

Venkatason, K. , Abdullah, K.A. , Sivaguru, S.
(2014) Applied Mechanics and Materials

View all related documents based on references

Find more related documents in Scopus based on:

Authors > Keywords >

10 (2006)
TNO, MADYMO Human Models Manual, in Madymo TNO Automotive: The Netherlands

11 (2009)
EuroNCAP, Pedestrian Testing Protocol, Version 4.3, Available at
http://www.euroncap.com/files/

12 (1998)
Improved Test methods to Evaluate Pedestrian Protection Afforded by Passenger Cars, EEVC Working Group 17 Report

13 Montgomery, D.C.
(1991) *Design and Analysis of Experiments*. Cited 18550 times.
3rd Edition

14 Hong, J.H., Mun, M.S., Song, S.H.
An Optimum Design Methodology Development Using A Statistical Technique For Vehicle Occupant Safety (2001)
Proceedings of IMechE, Part D:Journal of Automobile Engineering

15 Sahu, J.N., Acharya, J., Meikap, B.C.
Response surface modeling and optimization of chromium(VI) removal from aqueous solution using Tamarind wood activated carbon in batch process

(2009) *Journal of Hazardous Materials*, 172 (2-3), pp. 818-825. Cited 156 times.
doi: 10.1016/j.jhazmat.2009.07.075

View at Publisher

16 Sobieszczanski-Sobieski, J., Kodiyalam, S., Yang, R.Y.
Optimization of car body under constraints of noise, vibration, and harshness (NVH), and crash

(2001) *Structural and Multidisciplinary Optimization*, 22 (4), pp. 295-306. Cited 95 times.
doi: 10.1007/s00158-001-0150-6

View at Publisher

17 Yang, R.J., Gu, L., Tho, C.H., Sobieszczanski-Sobieski, J.
Multidisciplinary design optimization of a full vehicle with high performance computing

(2001) *19th AIAA Applied Aerodynamics Conference*. Cited 27 times.

18 Kausalyah, V., Shasthri, S., Abdullah, K.A., Idres, M.M., Shah, Q.H., Wong, S.V.
Optimisation of vehicle front-end geometry for adult and pediatric pedestrian protection

(2014) *International Journal of Crashworthiness*, 19 (2), pp. 153-160. Cited 8 times.
doi: 10.1080/13588265.2013.879506

View at Publisher

Kausalyah, V.; Department of Mechanical Engineering, Faculty of Engineering, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, Malaysia

Back to results | 1 of 1 Top of page